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Abstract

EXPERIENCE FROM THE COMMISSIONING, THE CRITICALITY EXPERIMENTS AND THE POWER OPERATION OF THE ÅGESTA NUCLEAR POWER PLANT

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The paper presents programmes of and experiments from the three major phases in the commissioning of the Ågesta Nuclear Power Plant.

Light water commissioning

The light water commissioning was carried out at room temperature from 1 December 1962 to 31 January 1963, and at higher temperatures from 1 February to 31 May.

The water rinsing brought out 2 grammes of dry material from the primary circuits.

The primary circuits and components performed well except in the following respects:

Valve operation by motors or manually via mechanical links was unsatisfactory;

One of the main pumps failed because of a break of a stator winding;

The electric heaters in the pressurizer failed by overheating.

Many adjustments were required before the light water circuits operated satisfactorily. Inleakage of air in a cooling circuit working at under-pressure was particularly difficult to overcome.

Criticality experiments

The criticality experiments were carried out at room temperature from 1 July to 31 October and at operating temperature from 1 November to 31 January 1964.

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The primary circuits were loaded with 76 123 kg heavy water of 99.825±0.002% D_2O-content before and 99.825±0.005% after the loading. Thus less than 5 kg light water remained from the commissioning.

All relevant control and safety equipment was connected during the criticality experiments. The fuel elements were successively loaded into the heavy water fuelled reactor tank. Neutron detectors were positioned in the core together with a compact neutron pulse source, which was used for determination of subcritical conditions from the neutron pulse decay rate. Spontaneous fissions in the fuel gave sufficient source neutrons.

The first criticality was achieved on 17 July with 23 (of totally 140) fuel elements loaded. Excess reactivities, control worths, reactivity coefficients of water level and neutron flux distributions were measured at three core sizes at room temperature. The effect of temperature on the reactor physics properties and the power distribution at different control rod configurations were determined with the full core.

The conservatively projected number of control rods could be considerably reduced as a result of these measurements, which also gave a valuable test of the new theoretical treatment of control rods in large reactor systems.

Primary circuit equipment and the instrumentation performed well, whereas the power supply equipment gave repeated though minor problems. Fourteen unscheduled scrams occurred from 15 July to 15 January, all due to equipment failure or personnel error.

The heavy water degradation, if any, lay within measuring uncertainty ±0.005%.

The heavy water losses were less than measuring uncertainty ±80 kg. Observed losses from loading operations and from a leaking valve amounted to less than 20 kg.

Power operation

The first approach to power will be made in four steps, resp. 1%, 20%, 50% and 100% of full power, 65 MW.

Experience of particular interest will be presented within the following fields:

Reactor Physics
Control and Instrumentation
Thermal Plant Engineering
Chemistry
Health Physics
Waste Disposal.